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CURRENT

DC INTERTIE REVIEW:
Should BPA maintain
the Celilo Converter
Station at 3,100 MW?

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The Bonneville Power Administration is exploring the future of its 30-year-old Celilo direct-current converter station and of the DC intertie. It is inviting customers and constituents to provide ideas and solutions on the level of DC intertie capacity that should be maintained over the next 30 years and on how to fund projects that would maintain that capacity at Celilo.

Celilo ties down the northern end of the 846-mile Pacific high-voltage direct-current intertie that ends at the Sylmar Converter Station in Los Angeles. Both stations convert alternating current into direct current and send it on its way with nearly no line losses to the other station where it is converted back into AC. Celilo sends south up to 3,100 MW of direct-current energy, which is more than enough to serve the 2,300 MW needed by the city of Los Angeles, and nearly three times what Seattle needs. (See box on pg. 6, "30 years of direct-current transmission.")

Southern partners ask for long-term capacity commitment

A 1993 fire at Sylmar and the 1994 Northridge earthquake severely damaged the converter station and the ground half of it sits on. Two of the intertie's southern partners have proposed to replace part of the Sylmar Converter Station at a cost of more than \$100 million, beginning in January 2001. The Los Angeles Department of Water and Power and Southern

Two partners on the southern end of the DC intertie have asked BPA to replace aging mercury arc valves on the northern end.

California Edison have asked BPA's Transmission Business Line to commit to maintaining its end of the DC intertie at the current 3,100 megawatt capacity for the

next 30 years. The capacity of the DC intertie is determined by the ratings of both Sylmar and Celilo. If either converter station is decreased, the total DC capacity is decreased.

The southern partners expect to complete the project by December 2003. A BPA decision could affect the southern partners' decision to move ahead on investments at Sylmar. Other southern owners include the cities of Glendale, Burbank and Pasadena.

If it commits to the southern partners' request, BPA's Transmission Business Line would have to make substantial investments to replace aging equipment at Celilo sometime within the next 15 years. The Celilo Converter Station has been extensively modified since



A 1994 earthquake in Los Angeles, Calif., and a subsequent fire severely damaged Sylmar. The Los Angeles Department of Water and Power and Southern California Edison expect to begin the replacement project in January 2001 and complete it by December 2003.

1970, but the original mercury arc converters are still in service and are now approaching the end of their useful lives. The mercury arc valves were designed for a 15-year life, but Celilo maintenance crews have been able to extend their life by finding sources for parts and by making some components. While it may be possible to do this for another 10 to 15 years, the cost of this maintenance will continue to rise as more and more components wear out.

Retiring the mercury arc converters at Celilo would reduce the intertie capacity to 1,100 MW.

BPA's funding and timing dilemma

The request by the partners and their proposed timeline pose a dilemma for the Transmission Business Line.

The dilemma comes in part because of the timing of the Sylmar project. The Transmission Business Line did not include such improvements as converter

replacements at Celilo in its current capital investment program approved in its FY 2002-03 rate case. It had not planned to make those investments as early as the timeline suggested by the southern partners. However, it did include funds to maintain the DC intertie's 3,100 MW rating through FY 2003, including a new control system, along with a number of other projects to improve transmission congestion in the Northwest.

The other part of the dilemma has to do with the use of the DC intertie. While it is used to near capacity four months of the year, it is often underused the remaining eight months. In addition, today only 700 MW of the DC intertie is under long-term firm contract.

This problem could be addressed by using a

methodology ensuring that either revenues come in year round or a payment stream is guaranteed that would cover the cost of future replacements, which could range from \$57 million to \$100 million.

At this point, BPA is not sure if it should commit to maintaining the DC line at 3,100 MW for 30 more years. That is why it has begun a public process to obtain the input of regional customers, constituents and interest groups to help the BPA administrator make a final decision. The process will give participants the opportunity to identify issues and make recommendations on how BPA should respond to this request.

Studies look at Celilo's future

BPA is currently studying the economic and social effects of either maintaining the DC intertie at 3,100 MW or at the projected capacity of about 1,100 MW once the mercury arc converters reach the end of their lives.

Economic study

To look more closely at the DC intertie's future from BPA's perspective, TBL recently completed a study that examines future surpluses in the Pacific Northwest and proposed new resource development in both the Northwest and Southwest. The study determines, based on historical precedent, how much of the 3,100 megawatts of capacity might be used on a long-term basis in the future.

It looked at the projected use of the intertie through 2019 and considered a number of paths TBL could take. However, it looked most closely at two basic alternatives:

1. Maintain the DC intertie at its current rating of 3,100 MW.
2. Retire the current mercury arc converters over time and make some additional investment in existing thyristor converters to bring the remaining system to a 1,650 MW level.

The study shows a significant decline in usage over the 20-year study period. However, that finding was based in part on data that predicted a decline in the Northwest power surplus, but it did not fully address the expected amount of new resource development.

It also found that the DC intertie gets heavy use during the peak marketing season – May through August – when the Pacific Northwest historically sells its lower cost surplus power to California. But there are many months of the year in which it is used very little.

Currently, marketers prefer selling over the alternating-current interties. The DC intertie is limited because the only place to take power off is at each end, so there are a limited number of markets in which to sell power from the DC intertie.

The study results of the net present value calculations (looking at transmission revenues and not power revenues) suggest that:

- Given current cost estimates, a business case cannot be made for replacing the mercury arc valves with used converters from the Sylmar Converter Station.
- Given current sales forecasts, there is a positive net present value for TBL associated with retiring the mercury arc converters and de-rating the DC intertie.
- The business case for maintaining the DC intertie at 3,100 MW is sensitive to the sales forecast. However, an optimistic sales forecast is needed to build a business case for maintaining the DC intertie at even 2,100 MW.



BPA's Celilo Converter Station sits near The Dalles, Ore., at the northern end of the DC intertie.

"An Economic Study of the Future of the Pacific HVDC intertie" can be found on the World Wide Web at http://www.transmission.bpa.gov/oasis/bpat/outagecoord/pdci_economic_study.doc.

Societal benefits and costs study

BPA has also begun a second study that will take a broader look at societal benefits and costs. Using the regionally accepted AURORA model, the study will consider benefits and costs from three perspectives:

BPA customers, Northwest customers and West Coast customers. It will primarily compare the net benefits for a 20-year period of maintaining the DC intertie at 3,100 MW to the 1,100 MW projected capacity once the mercury arc converters reach the end of their lives.

Results of the societal benefit and cost study will be shared with customers during October and will, along with the already completed economic study, provide the BPA administrator with the broader information about impacts of the DC intertie proposal that she will need to make her decision.

The public process

TBL is considering the southern participants' request, but it must first take into consideration the desires of its customers and it must be assured that the future use of the DC intertie will be sufficient to make the investment worthwhile. For that reason, the TBL is conducting a public process through Nov. 15 that will include opportunity for public input to help it make a decision regarding the southern partners' request. Two public meetings have been scheduled. The first is an overview of the economic study:

Oct. 17, 8 a.m. – noon
BPA Headquarters Building
Room 122
905 N.E. 11th Ave.
Portland, Ore.

A second public meeting will ask customers, constituents and other members of the public to comment on the southern partners' request:

Nov. 7, 8 a.m. – noon
Embassy Suites Portland Airport
7900 N.E. 82nd Ave.
Portland, Ore.



If BPA accepts the southern partners' proposal, Celilo's original mercury arc valves (pictured on page 2), still working but long past their expected life-span, would be replaced by silicon-based thyristors (above).

30 years of direct-current transmission

In August 2000, the Bonneville Power Administration, its employees and others celebrated 30 years of innovation and technological achievement at the Celilo Converter Station near The Dalles, Ore.

At one time, the DC intertie was considered the largest of its kind in the western hemisphere and continues to draw the interest of people from all over the world. For the entire 30 years of its existence, Celilo, the Sylmar Converter Station in Los Angeles, Calif., and the DC intertie have been at the forefront of direct-current transmission innovation worldwide.

Capacity expands through technology and innovation

Today Celilo sends south up to 3,100 MW of direct-current energy. But, when it was built in 1970 at a cost of \$65 million, its capacity was half that amount. Technology and innovation account for the more than doubling of Celilo's capacity over the 30 years of its existence.

The oldest mercury arc converters were installed at Celilo in 1969, and the latest innovation, the Siemens light-triggered thyristors, were installed in 1997. After the original mercury arc converters were installed, technology improvements increased the facility's capacity to 1,600 MW by 1979. Then the Voltage Upgrade Project increased its rating to 2,000 MW in 1985 by adding 100-kV thyristor groups in series with the existing mercury-arc groups. In 1989, thyristor converters 1 and 2 were constructed, and, ultimately, the capacity increased to its present rating of 3,100 MW.

In order to extend the life of the DC intertie another 30 years at its current 3,100 MW capacity, the original mercury arc converters would have to be replaced sometime over the next 15 years. BPA has estimated the cost of replacement at about \$70 to \$100 million. A mercury arc converter is a huge vacuum tube, a giant cousin of the tubes found in old radios and television sets.

DC intertie supports societal needs

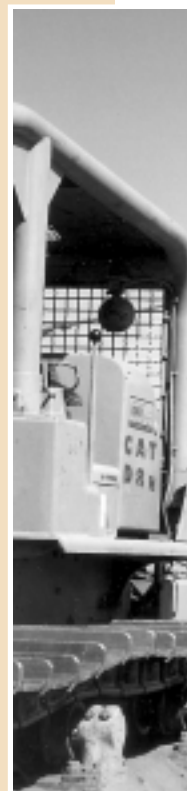
Celilo and the intertie it supports were not popular in some quarters when they were proposed. What won the day was engineering and new developments in DC technology. But more than that, it was the willingness to embrace the needs of society in both the Northwest and Southwest.

Some of those societal needs have been the ability to sell surplus power to California, while keeping rates low in the region. In spring and early summer, Northwest rivers usually provide more water for power generation than the region needs. That is when the DC intertie sends power south. Without the intertie, California would have to burn more fossil fuels to make electricity.

At other times, such as in winter and at night, California power plants generate more electricity than local people need and the power flows north to heat and light Northwest homes and businesses.

While alternating current dominates the power scene for everyday use, DC is a cheaper way to send large amounts of power over long distances, if the distance is great enough. DC transmission towers cost less than AC, DC requires only two suspended conductor cables, while AC needs three, and DC doesn't lose as much power along those lines. But first, alternating current must be changed to the steady one-direction flow of direct current and converter stations, like Celilo and Sylmar, are expensive. The distance beyond which DC transmission is cheaper than AC is about 400 miles.

Regardless of what the region determines is best for Celilo – whether to maintain it at its current 3,100 MW capacity or at a 1,100 MW capacity – its future will still be determined by innovation and technology.



Participants should be prepared to comment on the following questions:

- Should the Celilo Converter Station's rating be maintained at 3,100 MW?
- Does the DC intertie create benefits not captured by the economic analysis?
- Are there intangible benefits that should be considered?
- What alternatives should further studies consider? Hardware options? Financing and ownership options?



The DC intertie was built in 1970 with a capacity of 1,100 megawatts. New equipment at the converter stations has upgraded the capacity to 3,100 MW.

In addition, participants will be asked to explore various options, including ways to ensure a long-term revenue stream to pay for a replacement project at the northern end of the DC intertie, if that were to be the BPA administrator's decision. The revenue stream could include such things as longer-term contracts, an auction, or some other option.

For more information about the DC intertie issue, study and process, check the Web site at <http://www.transmission.bpa.gov/tbllib/dcintertie>.

Written comments on the DC intertie will be taken until Nov. 15. Send comments to:

BPA Public Involvement
P.O. Box 12999
Portland, OR 97212

or e-mail them to comment@bpa.gov.

If you have any questions, please call Mike Hansen at (503) 230-4328.



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